DOCUMENT RESUME

ED 153 642 IR 005 993

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TITLE Description and Evaluation of the Webster's Diacritical Markings. Computer-Assisted Instructional Program. Summary Report.
INSTITUTION National Technical Inst. for the Deaf, Rochester, N. Y.
PUB DATE Aug 75
NOTE 30p.; For related document, see IR 005 996

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Auditory Discrimination; *Aurally Handicapped; *Computer Assisted Instruction; Deaf Education; *Diacritical Marking; Faculty Development; *Program Descriptions; Pronunciation; Speech Instruction; *Staff Improvement; Summative Evaluation; Visible Speech; Visual Perception

ABSTRACT

The Webster diacritical system provides a discrete symbol for each sound and designates the appropriate syllable to be stressed in any polysyllabic word; the symbol system presents cues for correct production, auditory discrimination, and visual recognition of new words in print and as visual speech gestures. The Webster's Diacritical CAI Program is designed to provide cognitive skill in recognizing and using diacritical markings for newly employed faculty and staff at the National Technical Institute for the Deaf (NTID), and NTID students who have some auditory discrimination for speech. Photographs of a speaker producing the vowels and diphthongs were assembled in a handbook to use while viewing the CAI portion of the program which was developed for an IBM 1130/1500 system using cathode-ray tube and random access audio unit. Audio messages consisting of the sounds and words used in the program were recorded and inserted in the program. Pretest and post-test data accumulated for 40 new staff members and for 55 students indicate that the CAI program meets the individual needs of both students and faculty. Sequential frames demonstrating the instructional strategy and a flow chart designating the order of presentation are appended. (DAG)

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SUMMARY REPORT

Description and Evaluation of the Webster's Diacritical Markings Computer - Assisted Instructional Program.

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Prepared by

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August 1975

IR005993

SUMMARY REPORT

Project SDP - 39

Description and Evaluation of the Webster's Diacritical Markings - Computer Assisted Instruction Program

Joanne Subtelny and James von Feldt

Rationale for Program. The English language presents major difficulties for deaf students in both the written and spoken form. The rules of grammar are difficult to learn and apply. Spellings often provide little or no clues to the pronunciation of words. In introducing new words with their appropriate pronunciation and spelling to students, NTID classroom teachers have used various methods. Some have used the International Phonetic Alphabet, the Northampton Symbols (as used in many schools for the deaf), or home-made symbol systems. The use of one system throughout NTID would indeed be less confusing and very beneficial. Webster's diacritical system was selected for use in training NTID students and faculty because it will be most accessible in the student's future job situation.

The need to adopt and use a uniform system in presenting new words in writing as they sound, is based upon the concept that a central problem in post-secondary education of the deaf is language deficiency. This deficiency is expressed in many ways -- only one of which is difficulty in achieving intelligible speech.

The Webster diacritical system adopted provides a discrete symbol for each sound and designates the appropriate

syllable to be stressed in any polysyllabic word. The symbol system, therefore, presents cues for correct production, auditory discrimination and visual recognition of new words in print and as visible speech gestures.

Since 44% of the students entering NTID this summer, 1975, have intelligible speech, and 37% have sufficient hearing to discriminate some words within sentence context, it is apparent that new words should be presented auditorily, as they appear in print, and in a graphic system offering additional cues for correct pronunciation. Classroom instructors who follow the established recommended procedure of presenting new words in print, in diacritical symbols, in spoken form and within meaningful context, accomplish a great deal in reducing the language deficiency of deaf students. This procedure reinforces reading, spelling, auditory, speech and speech recognition skills. Whereas the majority of students cannot be expected to pronounce the word appropriately or to hear it accurately enough for identification, the multi-sensory approach in introducing words does make sense for <u>all</u> students. Those who cannot auditorily and/or visually perceive the word as spoken, can at least develop recognition and comprehension of that word in printed form.

In order to incorparate a multi-sensory approach in teaching new words to NTID students, it is mandatory that faculty, as well as students, develop competence in the use of the diacritical symbols.

To determine the competence of new staff members, 14 new staff members were given a short test (Summer, 1973) to evaluate their knowledge and functional usage of the diacritical symbols. Test results revealed none of the new staff (0%) achieved a passing grade of 70%, considered to indicate adequate knowledge of the system. These results clearly indicate that new staff, at the time of employment, do not possess requisite skills, thereby demonstrating the need for an instructional program for faculty as well as students.

Since all NTID faculty are attempting to communicate information, it is advisable for members of the faculty to impact in a uniform, multi-sensory manner, thus reinforcing each other in a combined effort to upgrade the language competence of all NTID students.

Use of a common diacritical system was strongly recommended as one way of accomplishing this purpose. To implement this recommendation, a computer-assisted instructional package with audio, was proposed to develop faculty and student skill in writing and reading words as they sound.

To summarize, the theoritical basis for using the diacritical symbols was established; 1) to facilitate teaching and learning new words, and 2) to improve communication skills of NTID students and foster competence in independent use of the dictionary. The need to develop skill in use of the system among new staff members and among NTID students has been documented. If the system is to be effective, it is obvious that both teachers and students require functional

knowledge of its use.

Objective. The objective of the Webster's Diacritical CAI Program is to provide cognitive skills in recognizing and using selected diacritical markings for:

(a) newly employed faculty and staff at NTID, and

(b) NTID students who have some auditory discrimination for speech.

The theoretical basis for this activity is to improve classroom instruction and to reinforce communication skills of students and faculty at NTID.

Description of the Program. The instructional package utilizing computer assisted instruction with audio-visual cues was developed with content purposely restricted in scope to remain within a one to two hour time limit and to meet differing levels of skill at entry. The content of the program was organized in three parts to include all symbols for the vowels, diphthongs and consonants c, ng, x, and qu. Sequential frames demonstrating the instructional strategy are presented in Appendix 1. A flowchart designating the order of presentation appears in Appendix 2.

Photogrpahs of a speaker producing the vowels and diphthongs were assembled in a handbook to use while viewing the program. The CAI portion of the program was developed for an IBM 1130 - 1500 system using cathode-ray tube and random access audio unit. Audio messages consisting of the sounds

and words used in the program were recorded and appropriately inserted in the program. In addition, a pre-post test (Appendix 3) and three review quizzes were constructed.

The program was debugged and corrected Fall Quarter, 1973, after a pilot investigation involving 15 faculty members in the Division of Communication Programs and 4 NTID students. The final revision made Spring, 1974, increased the passing criterion for the program from 65% to 80%. Data accumulated Summer 1974 from 15 new staff members, showed the final revision was definitely beneficial. This revision required more drill and practice before a participant was permitted to progress in the program. The beneficial effect of the revision was documented by the fact that the post-test means showed a 9% increase over previous means attained before increasing the passing criterion.[1]

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1 Pre-test scores consistently have documented the need to train new staff. The mean pre-test score for 24 faculty enrolled in new staff training Summer, 1974, was 39.8%.

Evaluation of the Program. Pre-post test data has been accumulated for 40 new staff members and for 55 NTID students who have taken the Webster's Diacritical CAI Program. As reported in Table 1, the pre-test mean for faculty was 49.35%, sd 17.91, with a post-test mean of 91.48%, sd 6.99. The t value (-16.243) indicates the gain was significant beyond the .01 level of confidence. The 91% post-test mean also indicates that all faculty met the established criterion of 80% after completing the program. None of the faculty scored lower than 80%. Individual pre and post test scores for faculty are graphed in Figure 1.

Table 1. Means, standard deviations and t values for test scores before and after taking the Webster's Diacritical Markings Computer Assisted Instruction Program.

Group	n	Pre-test		Post-test		t
NTID students	55	mean	54.39%	mean	86.14%	-21.146**
		sd	13.28	sd	8.32	
NTID Faculty	40	mean	49.35%	mean	91.48%	-16.243**
		sd	17.91	sd	6.99	

Table 1 also includes pre-post test data for the students who have completed the Webster's Diacritical CAI Program. The pre-test mean for the 55 students was 54.39%, sd 13.28, with a post test mean of 86.14%, sd 8.32. The t value (-21.146) again indicates a significant difference in pre and post test performance. Eighty-eight percent of the students achieved the criterion of 80% or better in the post-test situation. These results are graphed in Figure 2.

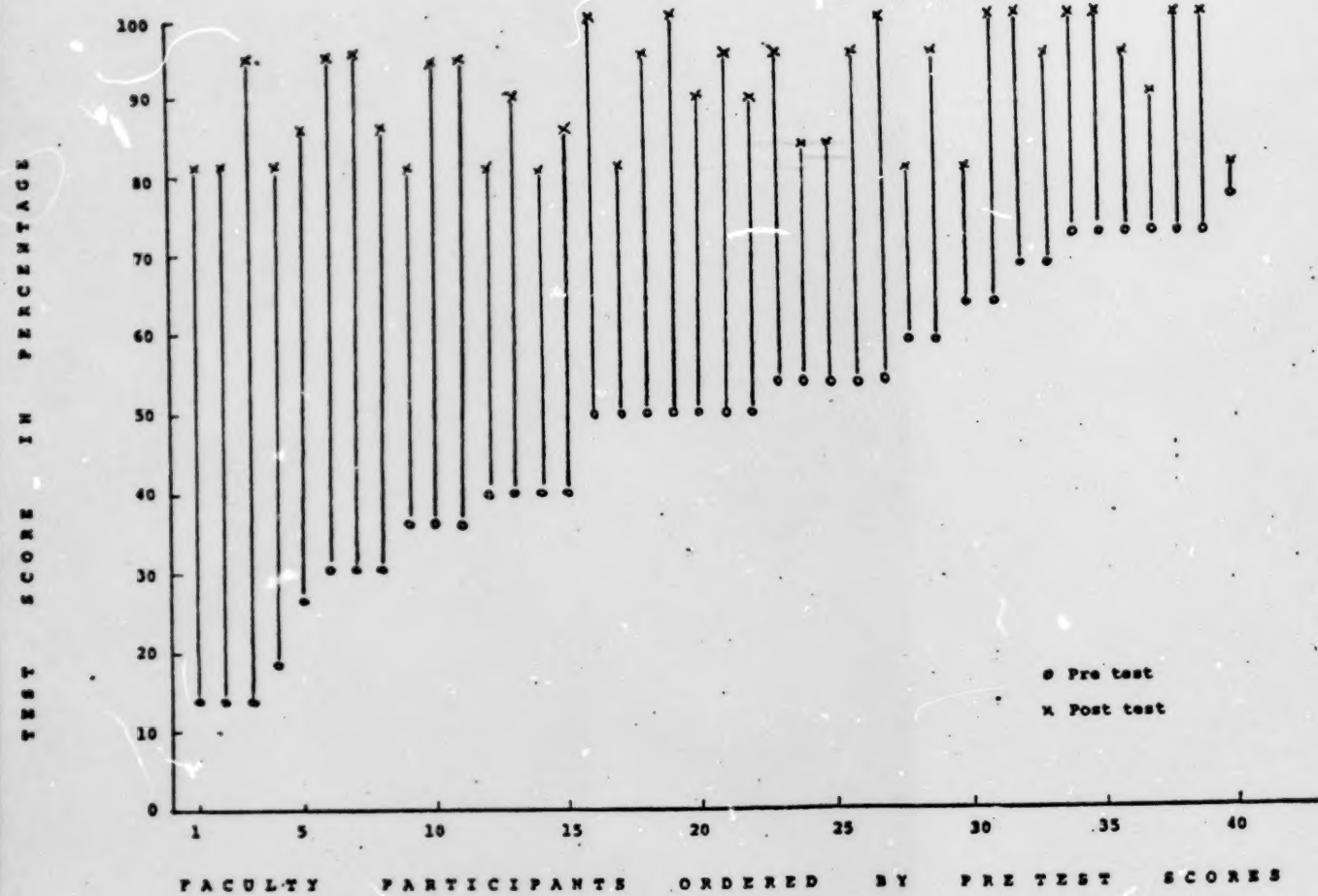


Figure 1. Pre and Post Test Scores graphed individually for Faculty Group (n 40).

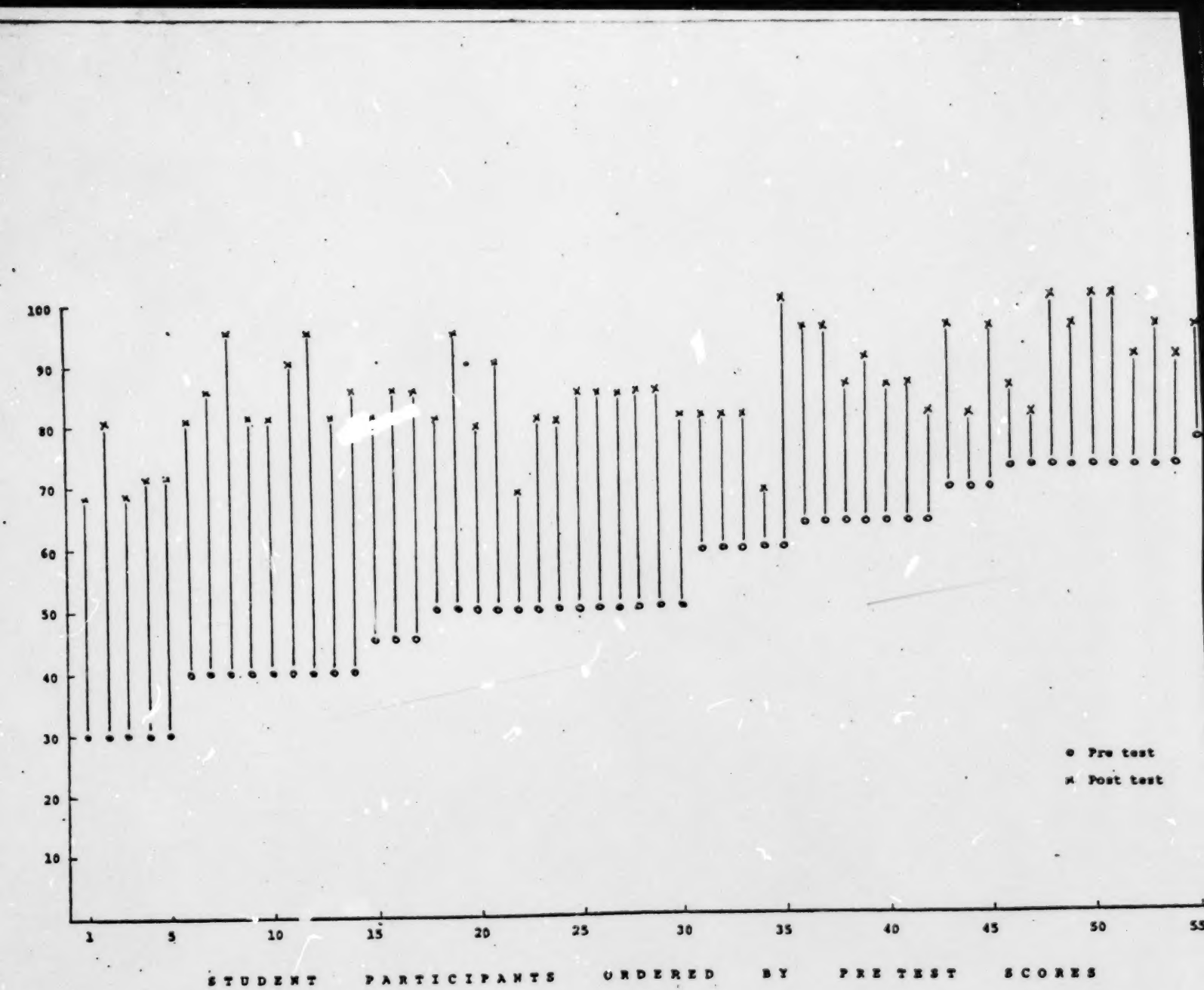


Figure 2. Pre and Post Test Scores graphed individually for Student Group (n 55).

The comparison between faculty and student groups are summarized in Table 2. As shown, faculty scored slightly lower (mean 49.35%) than students (mean 54.39%) in pre testing.

Table 2. Means, standard deviations and t values for pre and post test scores on the Webster's Diacritical Test for faculty and student groups.

		GROUP			
		Faculty (n=40)		Student (n=55)	t
Pre test	mean	49.35%	mean	54.39%	1.577
	sd	17.91	sd	13.28	
Post test	mean	91.48%	mean	86.14%	-3.299**
	sd	6.99	sd	8.32	

This difference was not statistically significant (+ 1.577) and may be attributed to the fact that the students had received more orientation to the diacritical system before taking the course. The faculty received only a brief one hour orientation, explaining the rationale for learning Webster's diacritical markings before beginning the program.

Post test results for faculty (mean 91.48%, sd 6.99) and students (mean 86.14%, sd 8.32) revealed the faculty post-test performance was significantly better than the hearing impaired student group (t -3.299).

In both groups, standard deviations for post tests as compared to pre tests were greatly reduced. To illustrate, in the faculty group, pre-test scores ranged from 13% correct to 77% correct; i.e., indicating a range in scores of 64%. Post-test scores of the faculty show a restricted range of 20 percent (80% t0 100% correct). This observation applied, to a lesser extent, in the student data as reported in Table 2. The pre test - post test reduction of standard deviations (faculty from 17.91 to 6.99, and student from 13.28 to 8.32) indicated that both groups expressed rather homegenious post test performance. Although entering the program with varying levels of skills, both student and faculty groups exited the program with a similar level of skill. This is interpreted as one indication that the CAI program was effective regardless of individual entry level. This finding is further supported by the significant correlations between gain and pre-test scores for both groups, as reported in Table 4. Pre and post test means with gain are graphically displayed for both groups in Figure 3.

In Table 3, percentage gain and time on line is presented for both groups. The mean for faculty gain (42.15%) was significantly greater than the mean for students (31.92%), however, there was no significant difference relative to time on line. On the average, both groups completed the program in less than an hour and a half.

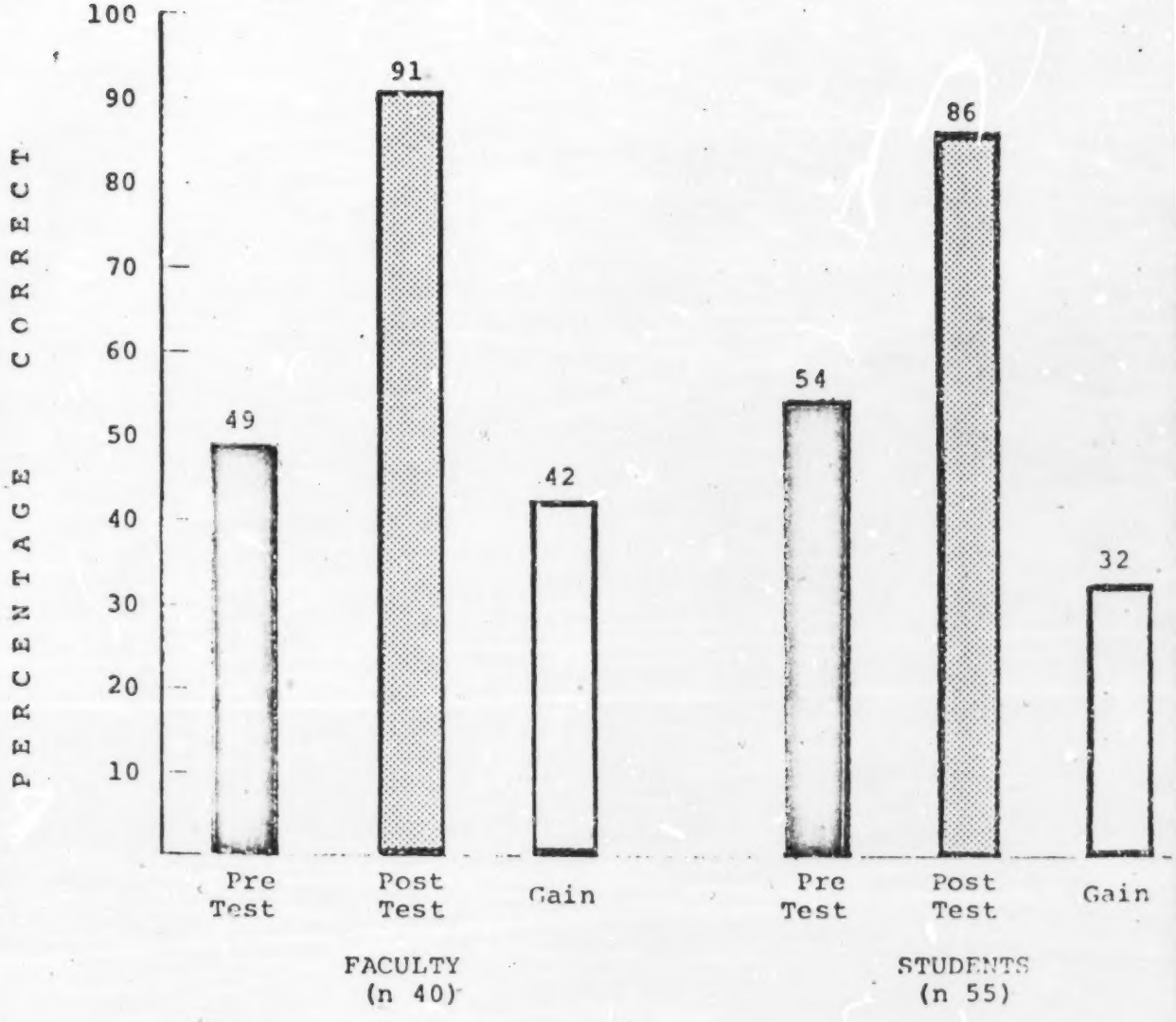


Figure 3. Mean test scores and percentage gain for faculty and student groups before and after completing Webster's Diacritical Marking Computer Assisted Instruction Program.

Table 3. Means, standard deviations and t values for percentage gain and time on line for faculty and students taking the Webster's Diacritical Marking Computer Assisted Instruction Program.

Measurement		Faculty (n=40)		Student (n=55)	t
Percentage Gain	mean	42.15%	mean	31.92%	-3.574**
	sd	16.47	sd	11.44	
Time on Line (hours)	mean	1.41 hr.	mean	1.32 hr	- .89
	sd	.43	sd	.51	

To evaluate possible relationships between gain and time on line and between gain and pre-test performance, correlations were statistically established as reported in Table 4.

Table 4. Percentage gain correlated with time on line required to complete the Webster's Diacritical Markings CAI Program and pre-test scores.

	Time on Line	Pre test Score
Student Gain	.261	- .778**
Faculty Gain	.551**	- .920**

Faculty gain was found to be significantly correlated with faculty time on line (r .551**). Student gain versus time on line approached but did not reach the 5% level of significance (r .261). In general, then, greater gain tended to be associated with more time on line.

Student and faculty percentage gains were negatively correlated with pre-test scores (r -.778** and r -.920** respectively). The students and faculty members with lower entry scores tended to show proportionately greater gain.

Profile ratings for hearing discrimination and for speech intelligibility were also correlated with percentage gain in the student group. However, it became evident that the audio unit used with the program was erratic in performance. Many times, the person administering the program was not informed and/or did not note whether or not the audio unit was functional. In some instances, a student would go on line twice to complete the program. One time he would have audio; the next time nothing. These complications in use of the audio eradicated any value to be derived from a correlated study of student gain and hearing discrimination. There was no significant correlation between gain and speech intelligibility in the student group.

Conclusion. The objective, to provide cognitive skills in recognizing and using selected diacritical markings - was successfully achieved by both the newly employed NTID faculty and for NTID students. One hundred percent of the new faculty and 88% of the students met or exceeded the minimal acceptable level of achievement (80% of all criteria). The CAI program effectively met the diverse individual needs of both students and faculty. No significant differences between the two groups were found relative to entrance scores or average time required to complete the course. Exit scores and percentage

gain were both significantly higher in the faculty group.

This report has demonstrated individualized instruction through Computer Assisted Instruction is effective in providing the specified skill to both students and faculty.

ACKNOWLEDGMENT

The authors acknowledge Ms. Marilyn Nutter and Ms. Ella Klueck for their work in developing this program under the direction of Dr. James von Feldt.

Dr. Fred Wilson's assistance in statistical analysis of data is also acknowledged with gratitude.

APPENDIX 1

Sequential frames demonstrating the instructional strategy of the Webster's Diacritical CAI Program

Appendix 1

SEQUENTIAL FRAMES FROM WEBDI DEMONSTRATING INSTRUCTIONAL STRATEGY

The purpose of this course is to teach you the symbols used in Webster's Dictionary to help you say words correctly.

1

You will need a film and a sound track. Put the earphones on and adjust the loudness level while I count to 10. Could you hear the numbers. Yes No

2

The way we say words and the way we spell words is often different. Listen to each word after it has been written on the screen.

Spelling		Speech
way	is said	wā
may	is said	mā
maid	is said	mād
aid	is said	ād
name	is said	nām
game	is said	gām

3

The spelling is not the same as the speech of each word. The symbol ā is used for the speech sound ā.

Listen to ā.

4

Here is another example using another symbol. Listen to each word after it has been written on the screen.

Spelling		Speech
moon	is said	mün
room	is said	rűm
grew	is said	grü
rule	is said	rűl
blue	is said	blü

5

The spelling is not the same as the speech of each word. The symbol ü is used for the speech sound ü.

Listen to ű.

6

The first symbol you will learn is ē.

The symbol ē looks like the letter e with a line above it.

Listen to ē and watch the speaker.

ē

ē

ē

7

Turn to page 1 of your book.

Now you say ē.

8

Listen to the e in these words after they have been written on the screen.

Spelling	Speech
me	mē
key	kē
bead	bēd
need	nēd
leave	lēv

9

e is the symbol used for the vowel sound in these words. Notice:

me	mē	e sounds like e
key	kē	ey sounds like ē
bead	bēd	ea sounds like ē
need	nēd	ee sounds like ē
leave	lēv	ea sounds like ē

10

W ould you like to see and hear these words again?

Yes No

Please point to a lighted box.

11

You will see 4 words. Point to the correct speech for each word.

	(a) bee		(a) deed
be	(b) bē	deed	(b) ded
	(c) be		(c) dēd
	(a) read		(a) ēl
read	(b) rēd	eel	(b) el
	(c) red		(c) ēēl

Listen to the word.
Choose the correct answer.
Point to a lighted box.

12

Good work!!!

13

You made some mistakes. Look at your answers.

Try these four words again.

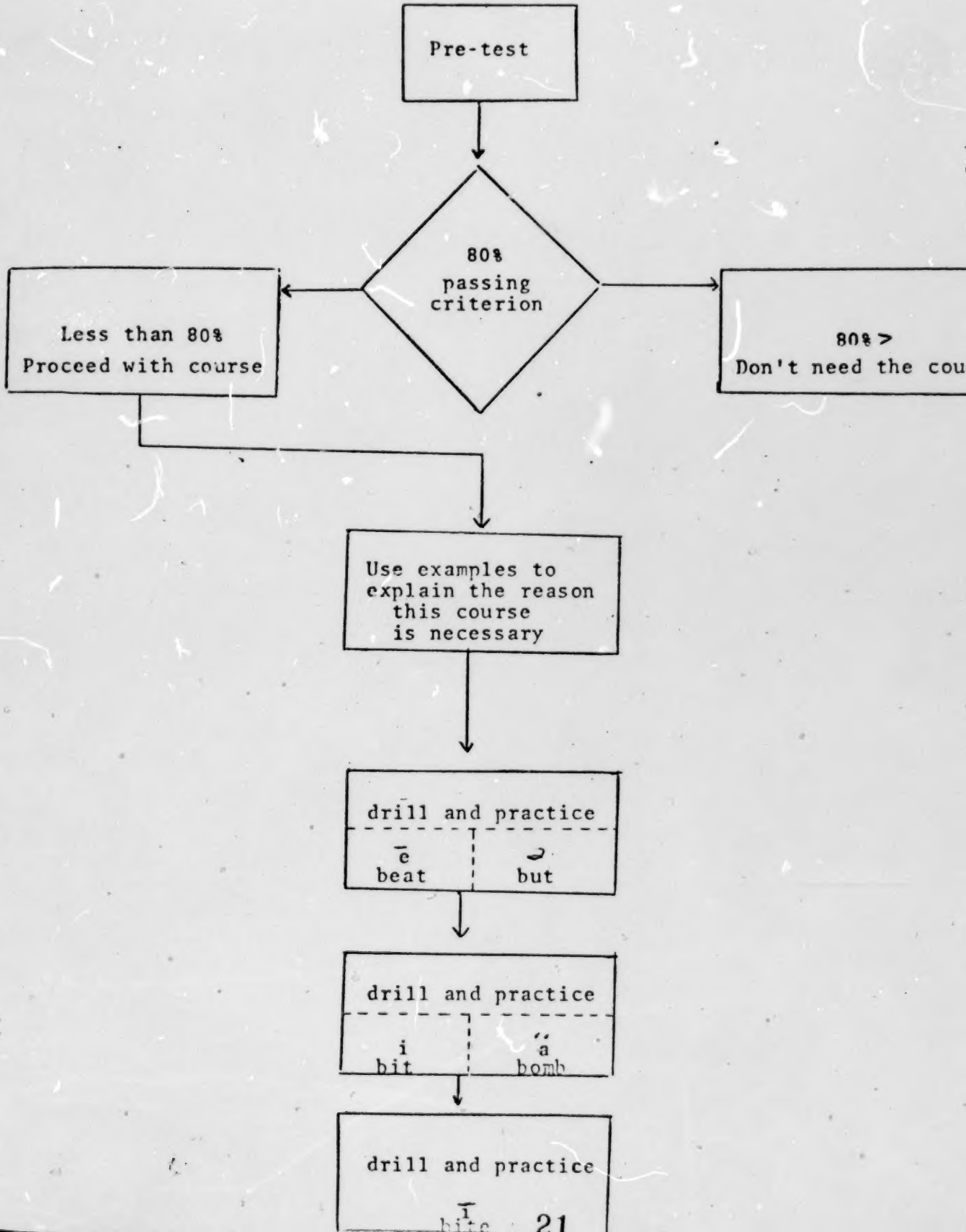
14

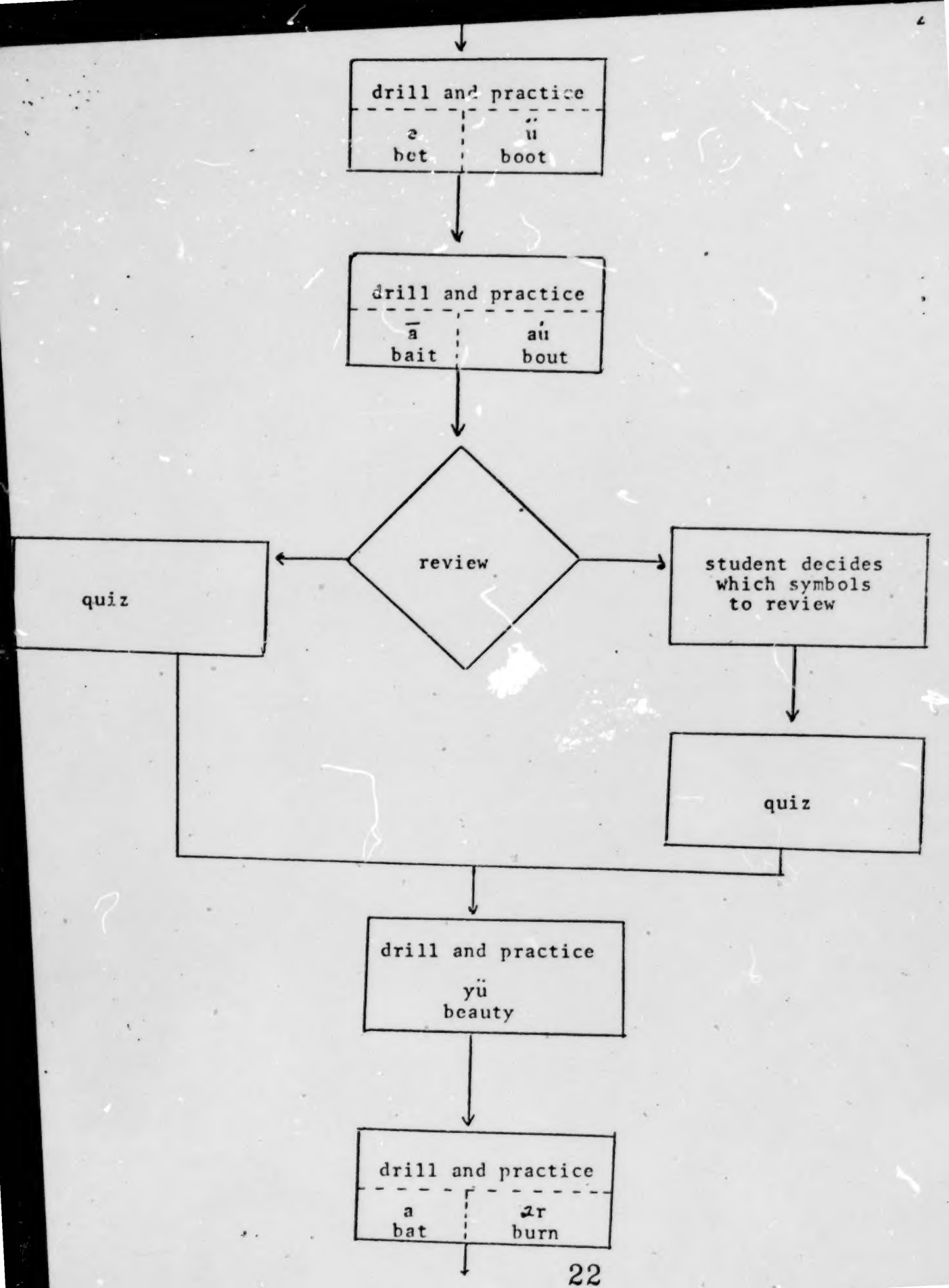
APPENDIX 2

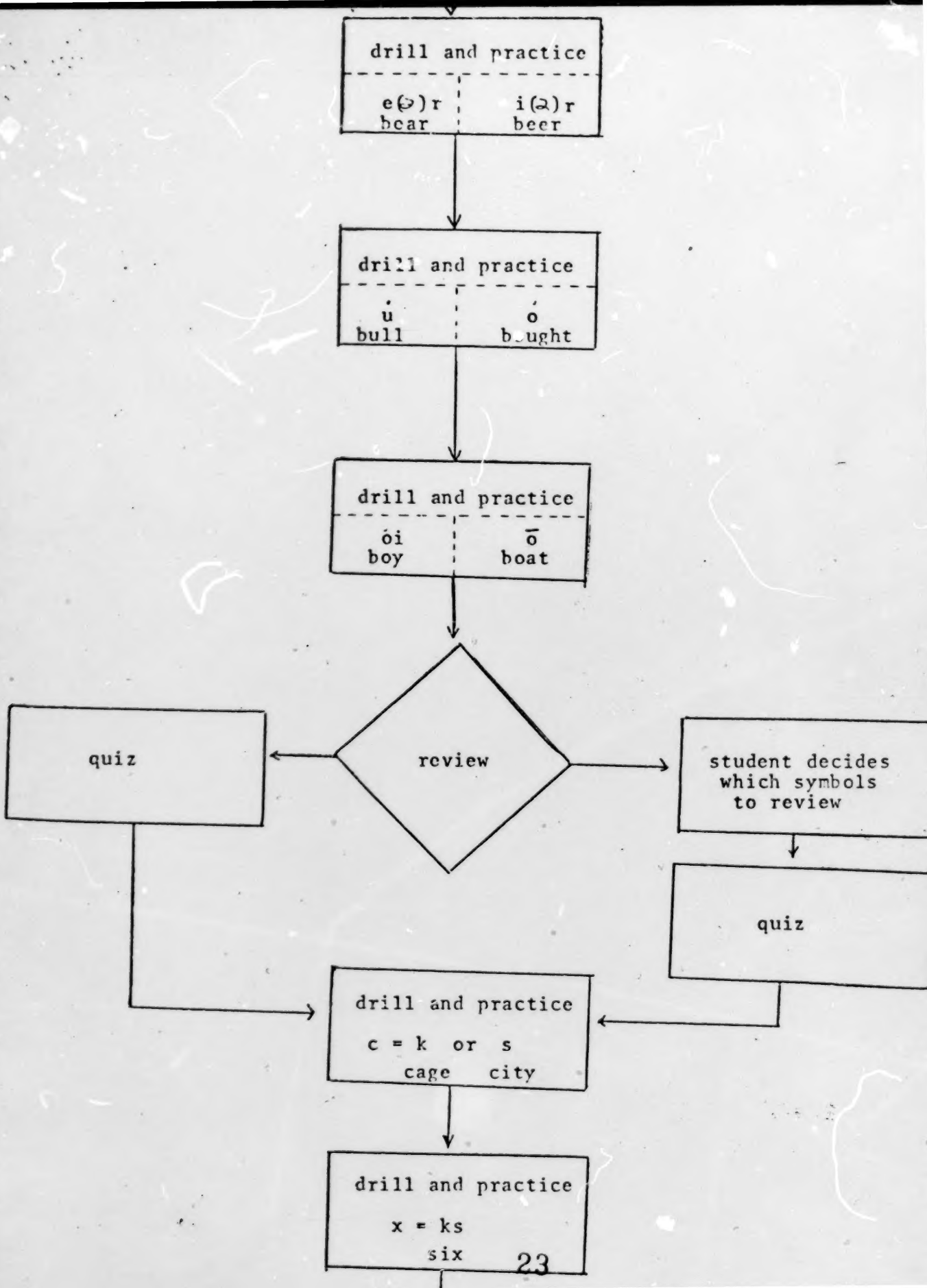
Flowchart of the

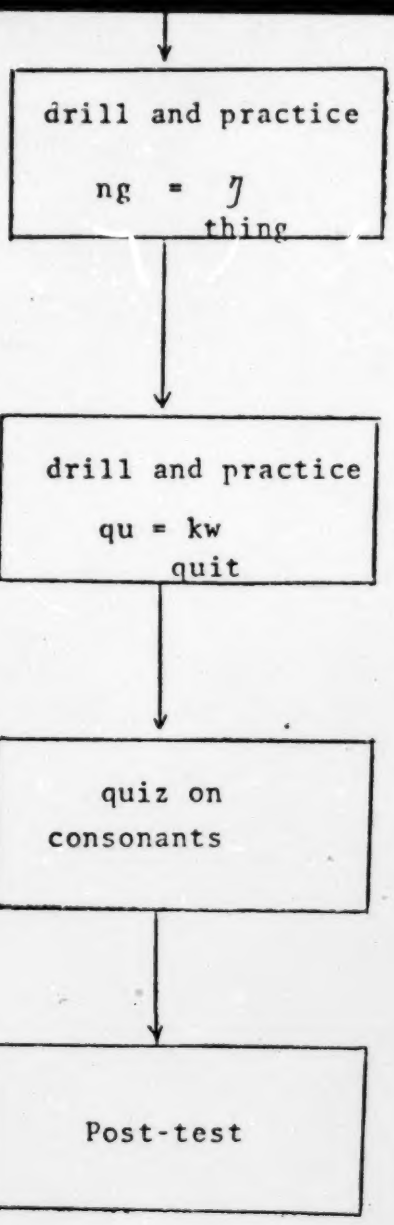
Webster's Diarcritical CAI Program

Flowchart of Webster's Diacritical CAI Program




drill and practice
e
bet
ü
boot
drill and practice
ā
bait
aú
bout
review
quiz
student decides which symbols to review
quiz
drill and practice
yü
beauty
drill and practice
a
bat
ar
burn


drill and practice
e(ɔ)r
bear
i(ə)r
beer
drill and practice
ú
bull
ó
bought
drill and practice
ói
boy
ō
boat
review
quiz
student decides which symbols to review
quiz
drill and practice
c = k or s
cage city
drill and practice
x = ks
six


drill and practice
ng = ŋ
thing
drill and practice
qu = kw
quit
quiz on
consonants
Post-test

APPENDIX 3

Pretest - Posttest of

Webster's Diacritical CAI Program

Appendix 3

WEBSTER'S DIACRITICAL TEST

Choose your answer from one of the four choices at the right. Mark your answer on the IBM card. DO NOT MARK ON THIS TEST.

1. The speech for the word "grin" is:
   A. grīn
   B. grin
   C. grən
   D. gren

2. The speech for the word "drop" is:
   A. drop
   B. dr̆op
   C. drap
   D. drōp

3. The speech for the word "read" is:
   A. read
   B. rad
   C. rad
   D. rēd

4. The speech for the word "run" is:
   A. ran
   B. rün
   C. růn
   D. rən

5. The speech for the word "dime" is:

A. dim
B. dime
C. dīm
D. dīme

6. The speech for the word "bread" is:

A. brēd
B. brəd
C. bread
D. bred

7. The speech for the word "blue" is:

A. blů
B. blu̎
C. blu̎e
D. blue

8. The speech for the word "maid" is:

A. mad
B. mīd
C. mād
D. moid

9. The speech for the word "mound" is:

A. mownd
B. mōnd
C. mound
D. maůnd

10. The speech for the word "menu" is:

A. 'men-yu̇
B. 'men-u̇
C. 'men-u̇
D. menu

11. The speech for the "grab" is:

A. grāb
B. grab
C. grab̈
D. grau̇b

12. The speech for the word "mother" is:

A. 'mə-thər
B. 'mə- th(ə)r
C. 'mə-ther
D. 'mə-thi(ə)r

13. The speech for the word "marry" is:

A. 'mē(ə) r-ē
B. 'mi(ə) r-ē
C. 'mar-ē
D. 'me (ə)r-ē

14. The speech for the word "beer" is:

A. bēr
B. ber
C. bi (ə)r
D. bēer

15. The speech for the word "good" is:

A. gůd
B. g̅o̅o̅d
C. g̈ud
D. gǒd

16. The speech for the word "law" is:

A. l̈a
B. laů
C. lǒ
D. law

17. The speech for the word "boy" is:

A. bǒi
B. bǒ
C. baů
D. bǒy

18. The speech for the word "loan" is:

A. lǒn
B. l̄ōn
C. l̄ōan
D. lǒan

19. Which word has the correct speech written next to it?

A. pencil /'pen-sɔl/
B. candy /'san-dē
C. code / sōd /
D. cell / kel /

20. Which word has the correct speech written next to it?

A. tax	/ tax /
B. box	/bäs/
C. fix	/fiks/
D. oxygen	/'äk-i-jin

21. Which word has the correct speech written next to it?

A. ring	/ rig /
B. longer	/'lȯn-gər/
C. sang	/ sang /
D. hungry	/'həŋ-grē/

22. Which word has the correct speech written next to it?

A. queer	/qui (ə)r/
B. square	/skwe(ə)r/
C. queen	/quēn/
D. quarter	/'kȯr-tər/